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Letter from the Editor

Improving biomaterials through matrix engineering

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The term extracellular matrix (ECM) has generated various associations throughout the history of medical research. While the spontaneously organizing fibers of connective tissue were originally thought to be the basis of life, the advent of the cellular concept by Rudolf Virchow put the ECM into the second line reducing their function to a mere scaffold and glue ("collagen"). Over the past decades our knowledge of the composition of the physiologic ECM has increased steadily and many possible interactions of several ECM components with cytokines and cell receptors have been discovered, making the ECM a promising target for improving the performance of biomaterials. The reviews in this Special Issue of *Biomatter* reflect the work of a Collaborative Research Center (TRR 67) of the Deutsche Forschungsgemeinschaft (DFG) based in Leipzig and Dresden, Germany, dedicated to matrix engineering in soft and hard tissues.

In the first review of this issue, Jürgen Schiller and Daniel Huster explore classical and new methods of characterizing the structure and composition of the ECM in biological tissues and engineered constructs. Especially fascinating is the potential of the combination of solid state nuclear magnetic resonance spectroscopy and soft-ionization mass spectromety, both methods that so far have only rarely been used for that purpose. The paper by Susanne Bierbaum and colleagues reviews the concept of creating an artificial extracellular matrix (aECM) based on the composition of the physiological ECM. The techniques of preparation and immobilization of the main ECM components, most notably collagen, noncollagenous glycoproteins, glycosaminoglycans and proteglycans are laid out. Furthermore, the main interactions of the various ECM components with cells, growth factors and cytokines are described. However, our knowledge on these mechanisms is still limited. The paper by Annelie Pichert and co-authors sheds light on the interaction between interleukin-8, a strong chemoattractant for polymorphonuclear leukocytes, and several glycosaminaoglycans. This article also highlights the potential of targeting the immune response to biomaterials by specifically altering sulfation of glycosaminoclycans. Still, the in vivo performance of aECM is hard to predict from in vitro experiments. The reviews by Yvonne Förster and Barbe Rentsch, together with their coworkers therefore focus on the results of small and large animal experiments using aECM either as surface coating of titanium bone implants or polycaprolactone-co-lactide scaffolds and as a modification of calcium phosphate-based bone substitute materials. While numerous issues still need to be resolved, the results of these studies are encouraging and warrant future research. The ultimate goal will be an effective in vivo tissue engineering for several applications by attracting the host cells and cytokines without the need of recombinant growth factors that need to be applied in unphysiologically high doses and do not display fully predictable results in clinical applications.

I would like to thank all the contributors to this issue for the huge amount of work they have put into it despite numerous obligations. I sincerely hope that the content is of interest to our readers and look forward to their feedback.

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